Dual-Frequency Feed Cone Assemblies for 34-Meter Antennas

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New Cassegrain cone assemblies have been designed for the upgrade of three 26-meter-diameter antennas to 34-meter diameter with improved performance. The new dual-frequency feed cone (SXD) provides both S- and X-band feed systems and traveling wave masers with a reflex reflector system to permit simultaneous operation analogous to the 64-meter antennas. One cone assembly has been completed and two more are in fabrication, with deliveries set for early and midyear 1979.

I. Introduction

In order to extend the capabilities of a subnet of 26-m antennas, three stations are being upgraded to 34-m diameter with improved structural and microwave performance. The early design and performance goals have been reported in earlier articles (Refs. 1 and 2).

II. SXD Cone Assembly for DSS 12

Since the last reporting, the first SXD cone has been fabricated, assembled, tested at high power, and transferred to operations for installation on the upgraded DSS 12 antenna during August 1978. The cone exterior is shown in Fig. 1. The S-band horn is in the foreground and the X-band horn is atop the cone extension.

Figure 2 shows the S-band diplexer and low-noise (receive-only) bypass loop of waveguide that connect to the switches. Part of the S-band feed horn can be seen behind the diplexer.

Figure 3 shows the lower portions of the S-band feed, including the polarizer and rotary joints. To the left of the picture is the transmitter waveguide run and transmit filter.

Figure 4 shows the X-band monitor receiver and maser support racks during the final stages of assembly and cabling. This is the first installation and use of the new traveling wave maser package design.

III. Performance Tests

During June the first SXD cone assembly was transported to the Microwave Test Facility at Goldstone and connected to the test transmitter. Repeated tests at 20 to 24 kW CW showed no significant noise bursts or system noise temperature increase while diplexing the cone-mounted maser. With the ellipsoidal reflector and dichroic plate mounted atop the cone, the same results were obtained. Measured system temperatures at S-band were approximately 14 kelvins in the low-noise

receive-only configuration (diplexer bypassed) and .22 kelvins in the diplexed configuration. It is expected that each of these figures will increase about 4 kelvins when the cone is mounted on the DSS 12 antenna due to quadripod scatter and spillover.

At X-band the system temperature was 17.5 K without the dichroic plate installed. Because of backscatter reaching the ground when the cone is not on the antenna, the installation of the dichroic plate caused a 3.6-K increase in noise temperature. This is expected to be reduced to less than 2.5 K on the antenna which, with the other contributions, should make the final X-band temperature about 24 K.

IV. Overseas SXD Cone Assemblies

Fabrication of all parts is nearly complete for two more SXD cones, and assembly of the second unit is beginning. Assembly of the third unit is expected to begin in September. When completed, these cone assemblies will also be tested at Goldstone prior to overseas shipment.

References

1. Hartop, R. W., "Dual Frequency Feed System for 26-Meter Antenna Conversion," in *The Deep Space Network Progress Report 42-40*, Jet Propulsion Laboratory, Pasadena, Calif., Aug 15, 1977.

2. Nixon, D. L., and Bathker, D., "S/X-Band Microwave Optics Design and Analysis for DSN 34-Meter-Diameter Antenna," in *The Deep Space Network Progress Report 42-41*, Jet Propulsion Laboratory, Pasadena, Calif., Oct 15, 1977.

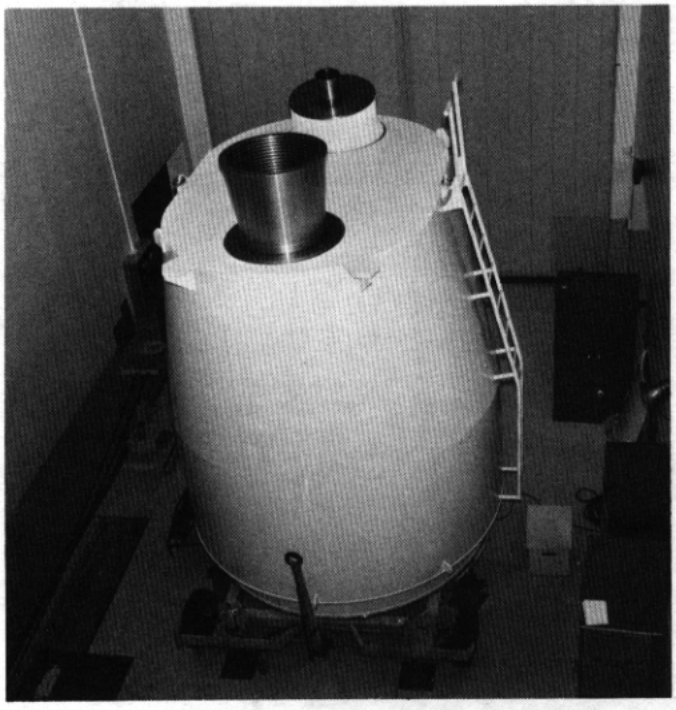

Fig. 1. SXD cone assembly

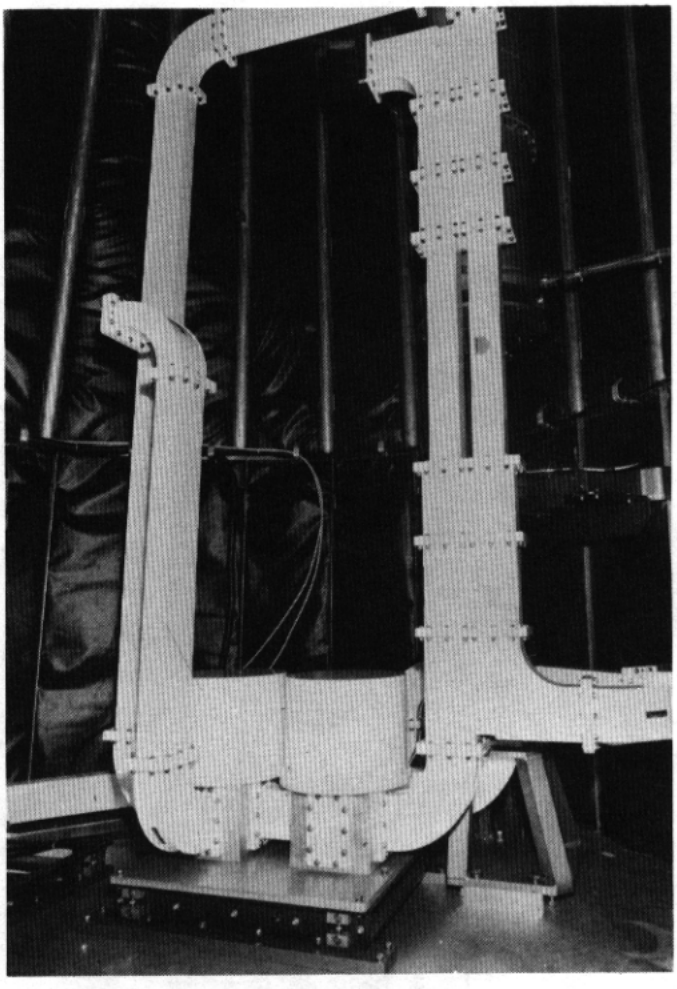

Fig. 2. Cone interior

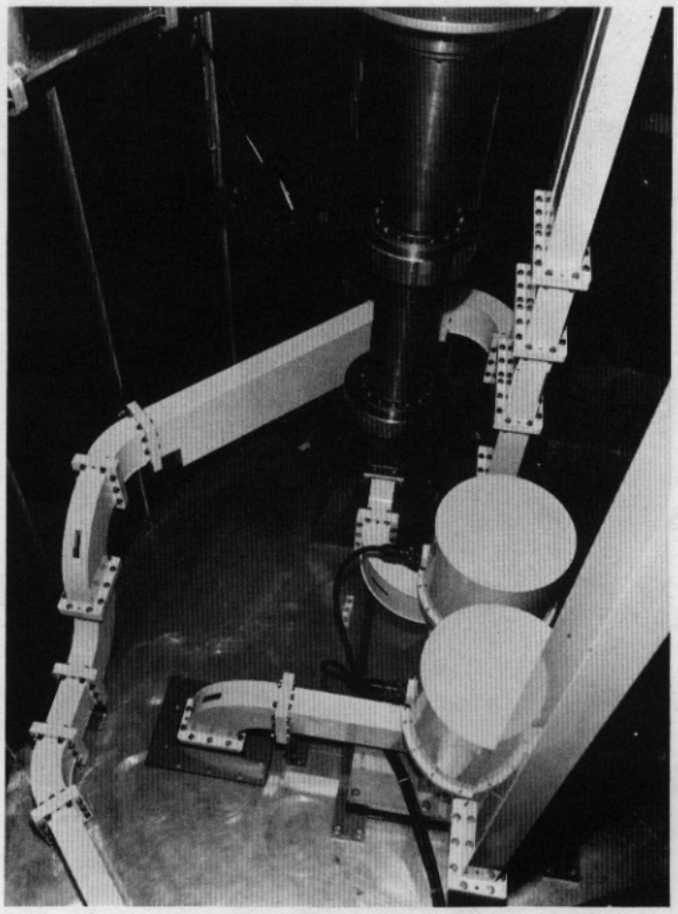

Fig. 3. Transmitter waveguide

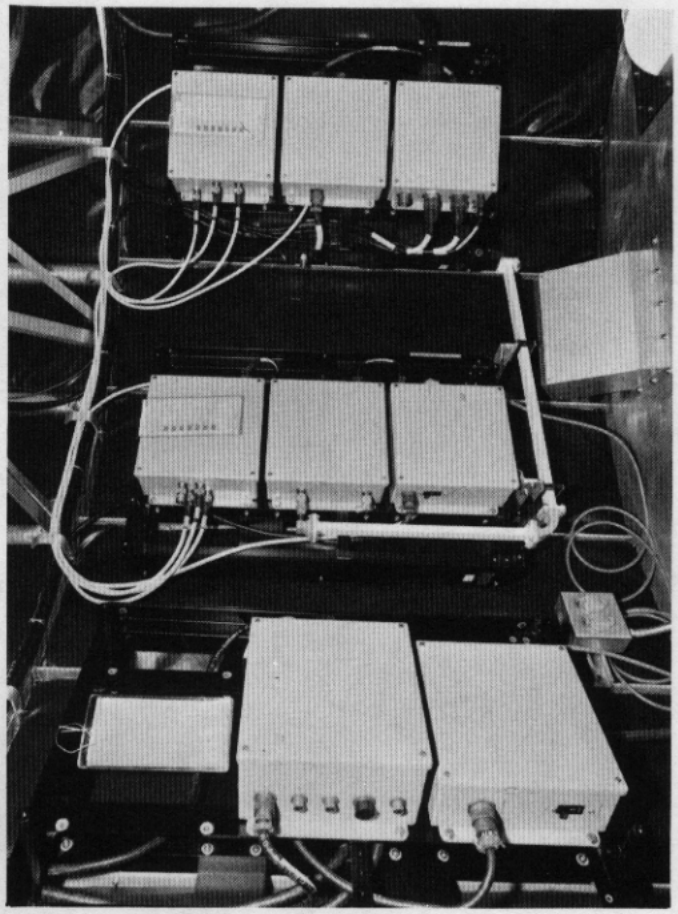

Fig. 4. Instrumentation racks